

**METHOD AND DEVICES FOR CONTROLLING OPTICAL PHASE DELAY UTILIZING
ELECTRICALLY TUNED LIQUID CRYSTAL NANO-STRUCTURES**

ABSTRACT OF THE DISCLOSURE

A method and devices for obtaining optical phase delay utilizing electrically tuned liquid crystal nano-structures are disclosed. In one preferred embodiment, an electrically tuned liquid crystal nano-structure provides optical phase delay. The disclosed device consists of cover plates, electrodes, nanometer scaled structures with polymer regions and regions filled with liquid crystal materials, and the controlling electronic circuit. By adjusting the applied electric field in the liquid crystal nano-structure, different polarization components of the incoming light will experience different phase delays without changing their propagating direction. In another preferred embodiment, an optical polarization tuner based on aforementioned electrically tuned liquid crystal nano-structures is disclosed. The polarization tuner consists of an polarization beam splitter, two electrically tuned liquid crystal nano-structures, and two beam folding prisms. By adjusting the applied electrical fields through the two liquid crystal nano-structures, light outputs with different polarization states are obtained. In yet another preferred embodiment, a spatial light modulator device based on aforementioned electrically tuned liquid crystal nano-structures is disclosed. The spatial light modulator consists of a nano-structured liquid crystal, a multi-channel electrode structure and controlling electronic circuit. The multi-channel electrode structure can be used to establish different electrical fields in different spatial regions such that the phase of the incoming light can be modified with spatial specificity.